

Contribution to the flora of Tirap Frontier Division

BY

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This paper presents an account of the flora of Tirap Frontier Division, North East Frontier Agency, India, and records higher plants ranging from Pteridophytes to Angiosperms collected in an intensive exploration of the area while covering about 300 km. on foot along the hill tracts. One new genus, *Pauia* Deb et Dutta, three new species, *Pauia belladonna* Deb et Dutta, *Boehmeria tirapensis* Deb et Dutta and *Pternopetalum senii* Deb et Dutta and a variety *Chirita macrophylla* Wall. var. *tirapensis* (Panigr.) Deb et Dutta, Comb. & Stat. nov. have already been described. Besides these, information has been obtained on the distribution of the taxa collected and on the phytogeography of the country. Other collections located in the regional herbarium at Shillong, which were inaccurately published or hitherto unpublished are included. The paper lists 905 species in 503 genera under 157 families. Short notes on the species have been added. The vegetation of the region studied has been described broadly.

INTRODUCTION

Tirap Frontier Division situated in the precipitous Patkoi ranges remained unexplored until recently, as it had no accessible tracks. The Botanical Survey of India after its reorganisation in 1955-56 took up exploration of the region through its Eastern Circle at Shillong. Three explorations were undertaken, the third being by the senior author. The area is still under-explored, and only the western half of the division bounded on the east by a line joining Jairampur with Pangsupass has been explored. However, in view of the importance of the collections made by the senior author during the intensive exploration on foot for about 300 km. along the hill tracts it was thought worthwhile to publish a floristic account. The study was started in June 1961, but the identification of our collection, and the re-examination of specimens gathered during the two previous explorations led to considerable delay. Several specimens had to be sent to the Royal Botanic Gardens, Kew, England, for determination, and we are grateful to the Director, Kew gardens, for assistance. While this note was under preparation, Panigrahi & Joseph (1966) contributed a paper on the former's collections from the area. His material has been excluded from the present paper excepting mis-

identifications which are corrected here. The area is floristically very rich, as is evident from the fact that the senior author's collection yielded one new genus, three new species, one new variety and a number of interesting records. These are listed separately under the heading 'New species & records'. Some have already been published (Deb & Kataki 1963, Deb & Dutta 1962, 1968). There still remains several interesting specimens which could not be determined due to paucity of material.

The paper deals with 905 species in 503 genera under 157 families from Pteridophytes to Angiosperms. Hutchinson's system (1959) has been followed for the Angiosperms but Elaeocarpaceae and Leeaceae have been kept distinct from Tiliaceae and Vitaceae respectively. For Pteridophytes the system proposed by Mehra (1961) has been followed. Under the family, genera and species have been listed in alphabetical order. Efforts have been made to find out the correct names in accordance with the 'International code of botanical nomenclature' (1967). Short notes on the species have been added. The vegetation of the region has been described broadly.

PHYSICAL FEATURES OF THE AREA

Situation: The North East Frontier Agency is bounded by Burma on the east, Tibet on the north and east, and Bhutan on the west. On the south lie Darrang, Lakhimpur and Sibsagar Districts of Assam and Tuensang Division of Nagaland. It covers an area of about 8,142,442 hectares of mountainous country spread like a giant horse-shoe between the Himalayas in the north and the Brahmaputra valley in the south. It includes five Divisions namely Kameng, Subansiri, Siang, Lohit and Tirap.

The Tirap Frontier Division lies between 26° 38' 24''-27° 21' 36'' N. and 95° 12'-97° 10' E. It is bounded by Burma on the east and south, by Lohit on the north and by Lakhimpur District of Assam and Tuensang division of Nagaland on the west. It covers an area of about 7,06,811 hectares. It has a plains area in its foothills and the hilly area rising gradually up to Patkaibum. The altitude varies from 150 m. in the plains to 4578 m. in Daphabum. The rivers and streams originate at the watershed of the hills and flow through the valleys into the Brahmaputra. Amongst these only the River Boral (Tirap) is worth mention. The rivers are shallow and slow in winter. After heavy rains in the Patkoi ranges, the rivers flood suddenly and the current is very swift.

Climate: The climate of the region varies in general with the change in altitude. It is hot and humid in the plains and the foothills. Sub-tropical climate prevails up to an altitude of 1500 m. above which it is temperate up to about 2700 m. Above this altitude there is heavy snow-fall in the winter. The rain fall is very high, and the annual average

varies from 3000 to 4000 mm. There is rain almost throughout the summer. Mid-April to mid-July are the wettest months. During our stay at Laju the maximum temperature recorded was 30°C. while the minimum was 18°C. Average relative humidity in June was 89%.

Geology: Geologically the Tirap Frontier Division is of recent origin and owes its formation to the upheaval of the Himalayas in pleiocene period of the Tertiary age.

The river beds are cut through massive boulders of gneiss and comprise sands mixed with pebbles. The hill ranges on the other hand consist of brown black alluvium of lateritic origin while the valleys comprise 'Bhabar' or matured alluvial deposits. The forest floor in the ranges close to Burma is covered by debris of leafy humus, some times 6 cm. or more in depth from accumulations of leaf mould through the centuries.

EXPLORATION

The Tirap Frontier Division was botanically an unexplored area until the recent surveys of the Botanical Survey of India. Dr. R. S. Rao spent two weeks in October 1959 from 8-x-1959 to 22-x-1959 and made collections at Jairampur, Nampong, Pangsupass, Chenglang, Khela and Deomali covering altitudes from 100 to 1130 m. He collected about 500 specimens.

Dr. G. Panigrahi collected in the southern part of the Division for 3 weeks from 19-viii-1958 to 10-ix-1958. He explored Chenglang, Khela, Khonsa, Kheti, Tinchha, Laju, Raho, Wakka, Niausa, Vanu, Banfera and Rusa. He collected about 1000 specimens. D. B. Deb collected for a month from 17-vi-1961 to 16-vii-1961. He studied the vegetation and made collection at Deomali, Chenglang, Khela, Khonsa, Tinchha, Laju, Kothong, Chennhang, Noglo, Raho, Wakka, Nginu, Niausa, Pongchow, Lunwa, Jadua, Banfera and Kanubari. He attempted an intensive study of the forests at Burma border, explored the border at several places for a comprehensive view of the vegetation and collected about 1100 specimens.

VEGETATION

The vegetation of the south western part of Tirap is broadly tropical evergreen, up to about 900 m. above sea-level, from where it is gradually replaced by subtropical forest between 900 and 1800 m., which in turn changes to the temperate type of vegetation from 1800 to 3500 m.

Dipterocarpus-Shorea-Mesua hylium occurs at Deomali. It is a dense evergreen forest covering an area of about 16×5 sq. km. *Dipterocarpus macrocarpus* Vesque, *Shorea assamica* Dyer, *Mesua ferrea* L.,

Manglietia insignis Bl., *Talauma hodgsoni* Hook. f. & Th. are the most dominant trees. These form the top canopy, though *Dipterocarpus macrocarpus* Vesque and *Shorea assamica* Dyer rise much above others. Natural regeneration of different ages was observed. *Terminalia myriocarpa* Heurck & Muell. occurs in gorges. *Syzygium fruticosum* (Roxb.) DC., *S. cumini* (Linn.) Skeels, *Saurauia roxburghii* Wall., *S. napaulensis* DC., *Knema angustifolia* (Roxb.) Warb. etc. form the middle storey. *Mussaenda* sp., *Osbeckia* sp., *Melastoma* sp. and many other plants of Verbenaceae, Rubiaceae, Acanthaceae occur in the under storey. *Uncaria sessilifructus* Roxb., *Pothos cathcartii* Schott, *P. scandens* Linn., *Byetneria aspera* Colebr., *Hoya parasitica* Wall., *Adenia trilobata* (Roxb.) Engl., *Myxopyrum smilacifolium* Bl., *Cissus assamica* (Laws.) Craib, *Piper peepuloides* Roxb., *Procris wightiana* Wall., *Vittaria elongata* Sw., *Piper thomsonii* Hook. f., *Dioscorea anguina* Roxb., *Rhaphidophora hookeri* Schott, *Schefflera venulosa* Harms. and other climbers are common. Amongst the orchids *Dendrobium chrysotoxum* Lindl., *Agrostophyllum khasianum* Griff., *Bulbophyllum affine* Lindl., *Coelogyne praecox* Lindl., *Cymbidium devonianum* Paxt., *Sarcanthus subulatus* (Bl.) Reichb. f., *Podochilus cultratus* Lindl., *Eria rufinula* Reichb. f. are most common. The forest is very dense, with places where light scarcely penetrates. Ground cover is thin and grasses are scarce.

Thick evergreen forest lies along the road from Khonsa to Deomali for a stretch of about 25 km. Trees are mostly with umbrageous crown and plank buttresses. Epiphytic orchids are common.

At Kanubari the forest is very much depleted but appears to be basically similar to that at Deomali, *Shorea assamica* Dyer being conspicuously absent. The forest is not so thick and biotic influence is more evident. Deciduous species also occur.

The vegetation along Margarita Chenglang road is a tropical evergreen forest. Trees are infested with lichens, climbers and epiphytes. *Talauma hodgsoni* Hook. f. & T., *Gynocardia odorata* R. Br., *Syzygium cumini* (Linn.) Skeels, *Knema angustifolia* (Roxb.) Warb., *K. linifolia* (Roxb.) Warb., *Saurauia napaulensis* DC., *S. punduana* Wall., *Ardisia griffithii* C. B. Clarke, *Cinnamomum pauciflorum* Nees are the common trees. *Rhaphidophora* sp., *Agapetes* sp., *Aeschynanthus* sp., *Hoya* sp., *Bauhinia* sp. are the common climbers.

At Chenglang *Cinnamomum pauciflorum* Nees, *C. tamala* Nees & Ebern, *Litsea monopetala* Pers., *Syzygium cumini* (L.) Skeels, *Gynocardia odorata* R. Br., *Phoebe lanceolata* Nees, *Terminalia myriocarpa* Hourck & Muell., *Quercus lanceaefolia* Roxb., *Styrax serrulatum* Roxb., *Ardisia griffithii* C. B. Clarke, *Elaeocarpus* sp., are also common. At localities where the forest has been denuded due to biotic influence *Kydia calycina* Roxb., *Vitex heterophylla* Roxb., *Stereospermum personatum* (Hassk.) Chatter., *Duabanga grandiflora* (Roxb.) Walp., *Bischofia javanica* Bl.,

Sterculia indica Merr. are occasionally associated. *Litsea citrata* Bl., *Itea macrophylla* Wall., *Alangium barbatum* R. Br., *Ardisia virens* Kurz, *Psychotria fulva* Buch.-Ham., *Antidesma bunius* Spreng., *Abroma angusta* L., *Mussaenda roxburghii* Hk. f., *Leea umbraculifera* L. etc., are common shrubs. *Costus speciosus* (Koenig) Smith, *Alpinia allughas* Rosc., *Polyura geminata* Hook. f., *Begonia* sp., *Forrestia mollissima* (Bl.), Koorders var. *hispida* (Less. & Rich.) Backer., *Commelina paludosa* Bl., *Polia haskarlii* Rolla Rao, *Amomum linguiforme* (Roxb.) Benth., *Phrynium placentarium* (Lour.) Merr., *Elatostema surculosa* Wt., *Spiradiclis biflora* Wall. ex Kurz, *Pratia begonifolia* Lindl., *Boeica filiformis* C. B. Clarke, *Boea multiflora* Bl., are the herbs. *Bauhinia khasiana* Baker, *Piper peepuloides* Roxb., species of *Dioscorea*, *Stephania*, *Gymnostemma*, *Trichosanthes* are common climbers. *Livistona jenkinsiana* Griff., *Wallichia caryotioides* Roxb., *Calamus erectus* Roxb., *Calamus floribundus* Griff. are some of the palms. Wild banana is very common in patches along the slopes of the forest which has been subjected to biotic interference.

At Khela the vegetation indicates a drier climate. *Trema orientalis* Bl. is very common. *Schima wallichii* Choisy, *Garuga pinnata* Roxb., *Stereospermum personatum* (Hassk.) Chatter. *Litsea monopetala* Pers., *Albizia stipulata* Boiv., *Macaranga denticulata* (Bl.) Muell.-Arg., *Pterospermum* sp., *Baccaurea sapida* (Roxb.) Muell.-Arg., *Bischofia javanica* Bl. are the common trees.

From Tinchha to Laju there is a vast expanse of grass land. Grasses commonly met with are *Imperata cylindrica* Beauv., *Setaria palmifolia* Stapf, *S. glauca* Beauv., *Panicum meleaceum* L., *Arundinella bengalensis* Druce, *Erianthus longischorus* Anders., *Capillipedium assimile* A. Camus. Here and there amongst the grasses are found *Gnaphalium luteo-album* L., *Achyranthes bidentata* Bl., *Alternanthera sessilis* Br. etc.

From Pungchow to Lunwa there is a vast grass land, dominated by *Phragmites karka* Trin., *Arundo donax* L., and *Imperata cylindrica* Beauv. In places *Alpinia allughas* Rosc. grows in pure stands and also in association with *Phragmites karka* Trin. Burnt off stumps of *Schima wallichii* Choisy, stand as witness of human influence in the change of vegetation.

At Raho the forest is almost completely denuded of the woody vegetation and land is utilised in cultivation of agricultural crops. At Wakka the vegetation is of temperate type and is dominated by *Quercus* sp., *Litsea lancifolia* Roxb. ex Wall., *L. thomsonii* Meissn., *Itea chinensis* Hook. & Arn., *Schima wallichii* Choisy, *Rhododendron arboreum* Sm., *R. vaccinioides* Hk. f., *Sambucus javanica* Bl., *Styrax serrulatum* Roxb. *Saurauja roxburghii* Wall. and *Saurauja napaulensis* DC. The vegetation along Niusa-Gnignu tract is much depleted and converted to cultivated lands. River banks and slopes are, however, covered with *Macro-*

panax undulatum Seem., *Pterospermum lanceaefolium* Roxb., *Lithocarpus fenestrata* (Roxb.) Rehder, *Syzygium fruticosum* (Roxb.) DC. and others.

Livistona speciosa Kurz, *Wallichia disticha* T. Anders. etc., form societies in patches. *Dendrocalamus hookeri* Munro is the common bamboo used for different domestic purposes.

Vegetation at the Burma border was studied at Kothong, Chennhang, Noglo and Lunwa. *Swietenia mahagoni* with tall erect bole and umbrageous crown dominates the vegetation at Noglo where as it is absent in other places. *Aucuba himalaica* Hook. f. is very common and forms large consociations in all these places. *Alnus nepalensis* D. Don, *Acer laevigatum* Wall., *Litsea semicarpifolia* (Wall.) Hook. f., *Litsea monopetalata* Pers., *L. lancifolia* Roxb. ex Wall., *Brassaiopsis glomerulata* (Bl.) Regel, *Casearia kurzii* C. B. Clarke, *C. vareca* Roxb., *Baliospermum montanum* Muel.-Arg., *Drypetes alata* (Bedd.) Pax & Hoffm., *Myrsine semiserrata* Wall., *Lithocarpus fenestrata* (Roxb.) Rehder are other common trees.

Amongst the shrubs *Lindera neesiana* Benth., *Hydrangea robusta* Hk. f. & Th., *Itea macrophylla* Wall., *Embelia vestita* Roxb., *Dichroa febrifuga* Lour., *Dobinea vulgaris* Buch.-Ham., *Ligustrum robustum* Bl., *Psychotria montana* Bl., *Rourea caudata* Planch., *Merillioanax listeri* (King) Li, *Viburnum odoratissimum* Ker, *Saurauja macrotricha* Kurz, *Buddleja macrostachya* Benth., *B. asiatica* Lour., *Alangium chinensis* (Lour.) Rehder are most common.

Bauhinia tenuiflora Watt ex C. B. Clarke, *Aristolochia saccata* Wall., *Illigera villosa* C. B. Clarke, *Lonicera macrantha* DC., *Actinidia callosa* Lindl., *Trachelospermum axillare* Hook. f., *Periploca calophylla* Falc., *Dioscorea bulbifera* L., *D. laurifolia* Wall. ex Hook. f., *Chonemorpha griffithii* Hook. f., *Melodinus khasianus* Hook. f., *Rubia sikkimensis* Kurz, *Streptolirion volubile* Edgew., *Smilax zeylanica* L., *Melodinus monogynus* Roxb. are most common climbers. Herbs are abundant. *Oenanthe thomsonii* C. B. Clarke, *Sanicula europaea* L., *Impatiens* sp., *Begonia* sp., *Ophiorhiza* sp., *Lysimachia ferruginea* Edgew., *Ranunculus diffusus* DC., *Cardamine* sp., *Hemiphragma heterophylla* Wall., *Pouzoulzia bennettiana* Wt., *Polygonum* sp., *Hydrocotyle javanica* Thunb., *Calaminta umbrosa* (Fisch. & May) Benth., *Disporum pullum* Salisb., *Paris polyphylla* Smith, *Chirita pumila* D. Don, *Vaccinium serratum* Wt., *Aeschynanthus bracteata* Wall. ex DC., *Aeschynanthus parasiticus* (Roxb.) Wall., *Lysionotus serratus* D. Don, *Pothos* sp., *Rhaphidophora* sp., and a host of orchids are common epiphytes.

NEW SPECIES AND RECORDS

In the course of the exploration of the region the senior author made intensive field studies which resulted in the discovery of several new taxa. One new genus *Pauia* Deb et Dutta under Solanaceae with one species

Pauia belladonna Deb et Dutta was discovered. The genus has been named in honour of Rev. Dr. H. Santapau, Director, Botanical Survey of India. It contains an alkaloid and deserves a thorough chemical investigation for medicinal properties.

Other species discovered and described are *Boehmeria tirapensis* Deb et Dutta (Urticaceae) and *Pternopetalum senii* Deb et Dutta (Umbelliferae). Deb 26312 has been treated as paratype in describing *Chirita macrophylla* Wall. subsp. *tirapensis* Panigr. in *Bull. Bot. Soc. Bengal* 21 (2): 32, 1967. Being the only flowering material available for describing the new taxon, it should have been treated as the holotype in place of *Panigrahi* 14795 which does not have any flower. However, this subspecies is reduced here to a variety as *Chirita macrophylla* Wall. var. *tirapensis* (Panigr.) Deb et Dutta, Comb. & Stat. nov. as it does not deserve a higher position on the basis of taxonomic differences from the type variety.

Besides these new taxa a number of other discoveries have been made from this region, which broaden our knowledge on the distribution of the taxa concerned and throw more light on the phytogeography of the country. *Gomphogyne macrocarpa* Cogn. ex Deb et Dutta, known from Manipur, *Fissistigma manubriatum* (Hook. f. & Th.) Merr. known from Burma, *Asarum himalaicum* Hook. f. & Th., var. *bhutanicum* W. W. Smith, known from Bhutan, *Isopyrum adiantifolium* Hook. f., & Th. known from Sikkim and Burma, *Strobilanthes glabratus* Nees known from Khasia and Jaintia Hills, *Passiflora assamica* Chakravarty known from Khasia Hills and Burma, *Galeola falconeri* Hook. f. a rare plant in the E. Himalayas, *Polystachya wightii* Reichb. f. known from Malabar, *Lysimachia congestiflora* Hemsl. and *L. rubiginosa* Hemsl. originally described from China, are some of the interesting taxa discovered in the region.

CULTIVATED PLANTS

The people inhabiting the region are Wanchos, Noctes, Tingsas, Shinghows and Khampitis. They are rice eaters, and cultivate rice in the valleys and in the hill slopes, sometimes with much hardship. As an alternate grain, they grow in jhum and terrace system of cultivation, *Zea mays* Linn., *Setaria italica* (L.) P. Beauv., *Eleusine coracana* Gaertn., *Pennisetum typhoideum* Rich. and *Hordeum vulgare* L. In house compounds and rarely in fields they cultivate also *Coix lachrymajobi* L. var. *mayuen* (Romanet) Stapf for use mainly in preparing beverages. For pulses and vegetables they cultivate *Cajanus cajan* (Linn.) Druce, *Canavalia gladiata* (Jacq.) DC., *Cicer arietinum* Linn., *Phaseolus calcaratus* Roxb., *Dolichos lablab* Linn., *Glycine max* Merr., *Solanum tuberosum* Linn., *Ipomoea batatas* Lamk., *Benincasa hispida* (Thunb.) Cogn., *Lage-*

naria leucantha (Duch.) Rusby, *Cucurbita pepo* DC., *Colocasia esculenta* (Linn.) Schott, *Abelmoschus esculentus* (L.) Moench., *Solanum melongena* Linn., *Lycopersicon esculentum* Mill., *Capsicum annuum* Linn. and others.

Sesamum indicum L., *Brassica juncea* Czern. & Coss., *B. rugosa* Prain, *Perilla frutescens* Britt. etc., are cultivated for oil seeds.

Zanthoxylum armatum DC. and *Eryngium foetidum* Linn. are cultivated in house compounds for the leaves used in curries and the fruits used as pepper. *Amomum aromaticum* Roxb. is sometimes cultivated for cardamom, and *Curcuma domestica* Valetton for turmeric.

Many wild plants are used by the local people as vegetables.

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PTERIDOPHYTE

EQUISETACEAE

***Equisetum debile* Roxb. ex Vaucher**

A tall perennial herb among bushes near streamlets. Cone greenish brown or grey; common. Nampong-Pangsupass, Oct. 1959, Rao 20040.

***E. diffusum* D. Don**

A perennial herb in moist shady places or rock crevices. Stiff fertile cones are almost covered by annulus when young; common. Nampong-Pangsupass, March 1958, Murthy 13008; Khela, March 1958, Murthy 12969; Chenglang, March 1958, Murthy 12929; Kothong, June 1961, Deb 26103; Khela, June 1961, Deb 25940.

SELAGINELLACEAE

***Selaginella helferi* Wart.**

A herb on moist humus. Fertile fronds are fan-like; common. Nampong-Pangsupass, Oct. 1959, Rao 20044, 20066; Namchik, Oct. 1959, Rao 20179.

***S. pallida* (Hook. et Grev.) Spring**

A herb; common. Chennhang, June 1961, Deb 26202.

S. pentagona Spring

An erect herb on moist hill slopes, caudex thin, fertile; fairly common. Chenglang-Khela, Oct. 1959, *Rao* 20269, 20276.

S. picta A. Br. ex Bak.

A herb in shade on rocky soil; not rare. Longseck, June 1961, *Deb* 25768.

S. semicordata (Wall.) Spring

A herb on moist ground among other bushes and grasses, frond fertile; not scarce. Margharita-Jairampur, Oct. 1959, *Rao* 19921; Nampong-Pangsupass, Oct. 1959, *Rao* 20043; Deomali, Oct. 1959, *Rao* 20311.

S. subdiaphana (Wall.) Spring

An annual; frond very thin, membranous, fertile; common. Chenglang-Khela, Oct. 1959, *Rao* 20275.

S. wallichii (Hook. & Grev.) Spring

A herb with fertile frond; common. Kanubari, July 1961, *Deb* 26756.

S. willdenovii (Desv.) Bak.

A climbing herb in moist shady places; common. Nampong-Pangsupass, Oct. 1959, *Rao* 20050.

LYCOPODIACEAE

Lycopodium cernuum Linn.

A herb among bushes with fertile cones. Sometimes creeping on rock crevices; common. Khela, June 1961, *Deb* 25941; Nampong-Pangsupass, Oct. 1959, *Rao* 20029.

L. clavatum Linn.

A herb with long sporophylls; rare. Noglo, June 1961, *Deb* 26359.

L. squarosum Forst.

An epiphyte; rare. Khonsa-Laju, June 1961, *Deb* 26015.

PSILOTACEAE

Psilotum nudum (Linn.) P. Beauv.

A lithophyte among tall grasses; rare. Nampong-Pangsupass, Oct. 1959, *Rao* 20146.

SCHIZAEACEAE

Lygodium flexuosum (Linn.) Sw.

A twining fern on shrubs. Sori dirty brown, marginal on every lobe; rare. Khela-Chenglang, March 1958, *Murthy* 12987; Deomali, Oct. 1959, *Rao* 20305.

L. scandens (Linn.) Sw.

A twiner on bushes; rare. Nampong-Pangsupass, Oct. 1959, *Rao* 20036.

VITTARIACEAE

Vittaria elongata Sw.

An epiphyte on trees, frond fertile; common. Deomali, June 1961, *Deb* 25908.

V. ensiformis Sw. var. **latifolia** Holtt.

An epiphyte; frond fertile; sori linear near the margin at the middle of the lamina; rare. Noglo, June 1961, *Deb* 26361.

ANTROPHYCEAE

Antrophyum reticulatum (Forst.) Kaulf.

An epiphyte with broad, sessile, fertile frond; sori without indusium; not rare. Khela, March 1958, *Murthy* 12971; Raho-Wakka, July 1961, *Deb* 26450; Chenglang, Oct. 1959, *Rao* 20250.

CRYPTOGRAMMACEAE

Onychium siliculosum (Desv.) C. Chr.

A terrestrial fern; frond fertile, sori yellow; not rare. Chenglang-Khela, Oct. 1959, *Rao* 20273.

PTERIDACEAE

Pteris cretica Linn.

A terrestrial fern; sori along the margin of the frond; common. Noglo, June 1961, *Deb* 26305.

P. excelsa Gaud.

In shady moist soil slopes; frond fertile, sori marginal; not rare. Khela, March 1958, *Murthy* 12962.

P. quadriaurita Retz.

A terrestrial fern in humid humus cover; caudex tufted, fertile; not scarce. Khonsa-Laju, June 1961, *Deb* 26019.

P. semipinnata Linn.

A terrestrial fern of sandy areas; caudex tufted; not rare. Nampong-Pangsupass, Oct. 1959, *Rao* 20061; Banfera, July 1961, *Deb* 26723.

HYPOLEPIDACEAE

Pteridium aquilinum (Linn.) Kuhn.

A fern with creeping, under-ground rhizomes; frond fertile; common. Khela, March 1958, *Murthy* 12978.

DAVALLIACEAE

Davallia griffithiana Hook.

An epiphyte on trees; frond fertile, sori oblong; not rare. Kothong, June 1961, *Deb* 26113.

OLEANDRACEAE

Naphrolepis cordifolia (Linn.) Presl

An epiphyte. Caudex tufted, sori crescent-shaped. Very common on wet ever-green forest. Kothong, June 1961, *Deb* 26107; Khonsa-Laju, June 1961, *Deb* 26020.

DICKSONIACEAE

Cibotium barometz (Linn.) J. Smith

A terrestrial fern with fertile frond (Tree fern); common. Banfera, July 1961, *Deb* 26724.

CYATHEACEAE

Alsophila glauca (Bl.) J. Smith

Pinnea bipinnately compound; common. Nampong-Pangsupass, Oct. 1959, *Rao* 20147.

A. ornata Schott

A terrestrial tree fern; frond circinate; common. Chennhang, June 1961, *Deb* 26201.

ASPIDIACEAE

Heterogonium saxicolum (Bl.) Holtt.

An epiphyte; frond fertile; common. Kothong, June 1961, *Deb* 26033.

Polystichum aculeatum (Linn.) Schott

An epiphyte; caudex tufted. On the wet forest floor near streams; not rare. Langsang, June 1961, *Deb* 26172.

P. lentum (Don) Moore

A terrestrial fern on rocks; frond fertile; common. Chennhang, June 1961, *Deb* 26230.

Tactaria polymorpha (Wall.) Copel.

A terrestrial fern with fertile frond and creeping rhizome; common. Lailongsong, June 1961, *Deb* 25846; Raho, July 1961, *Deb* 26391.

ATHYRIACEAE

Athyrium drepanopterum (Kze.) A. Br. ex Milde

A terrestrial fern; caudex semierect; frond fertile. Growing mostly on rocks; common. Khonsa-Laju, June 1961, *Deb* 26016.

THELYPTERIDACEAE

Cyclosorus acuminatus (Houltt.) Ching var. **glabrum** (Houltt.) Ching

An epiphytic fern with creeping rhizome; frond fertile; rare. Khonsa, June 1961, *Deb* 25915.

C. megaphyllus (Mett.) Ching

An epiphyte; caudex tufted; frond fertile; common. Chegum-Wakka, July 1961, *Deb* 26499.

C. parasiticus (Linn.) Ferwell

A terrestrial herb with erect caudex and fertile frond; common. Tipang, June 1961, *Deb* 25703; Longseck hillock, June 1961, *Deb* 25769.

C. sagittifolius (Bl.) Copel.

A terrestrial fern with erect caudex; basal pair of the pinnae reduced to auricles; common. Kothong, June 1961, *Deb* 26104.

C. sumatranus (V.A.V.R.) Ching

A terrestrial fern with erect caudex; sori along the margin of the pinnae; not rare. Lailongsong, June 1961, *Deb* 25842.

Thelypteris subpubescens (Bl.) K. Iwats.

A terrestrial fern; frond fertile. Khonsa, June 1961, *Deb* 25926.

ASPLENIACEAE

Asplenium ensiforme Wall. ex Hook. et Grev.

An epiphyte; frond fertile; not rare. Noglo, June 1961, *Deb* 26362.

A. nidus Linn.

An epiphyte; frond fertile, about 1 m. long; common. Namchick, Oct. 1959, *Rao* 20181; Langsang forest, June 1961, *Deb* 26169; Margharita-Jairampur, Oct. 1959, *Rao* 19962.

A. rutaefolium (Berg.) Kuntze

An epiphyte; frond fertile; not scarce. Chennhang, June 1961, *Deb* 26296; Raho-Wakka, July 1961, *Deb* 26451.

A. spathulinum J. Smith

A terrestrial or an epiphyte; frond fertile, not rare. Margharita-Jairampur, Oct. 1959, *Rao* 19955.

BLECHNACEAE

Blechnum orientale Linn.

A rhizomatous herb with erect caudex; frond fertile; common. Tipang, June 1961, *Deb* 25704; Margharita-Jairampur, Oct. 1959, *Rao* 19944.

LOXOGRAMMACEAE

Loxogramme flavescens Presl

An epiphyte on trees; sori arranged acropetally; rare. Khela, March 1958, *Murthy* 12972.

L. lanceolata Presl

An epiphyte on mossy bark, frond fertile; not scarce. Chennhang, June 1961, *Deb* 26297.

POLYPODIACEAE

Aglaomorpha coronans (Wall. ex Mett.) Copel.

An epiphyte or a lithophyte; frond fertile; not rare. Banfera, July 1961, *Deb* 26725.

Colysis elliptica (Thunb.) Ching var. **pothifolia** (Don) Ching

An epiphyte with rhizome; frond fertile; not rare. Chennhang, June, 1961, *Deb* 26299.

C. pedunculata (Hook. et Grev.) Ching

An epiphyte; frond fertile. Jadua-Banfera, July 1961, *Deb* 26693.

Drynaria propinqua (Wall.) J. Smith

An epiphyte with rhizome; common. Khonsa-Laju, June 1961, *Deb* 26017.

Lemmaphyllum rostratum (Bedd.) Tagawa

An epiphyte with wavy rhizome, frond fertile. Chennhang, June 1961, *Deb* 26298.

Lepisorus excavatus (Bory.) Ching

An epiphyte; not rare. Khonsa-Laju, June 1961, *Deb* 26018.

L. macrosphaerus (Bak.) Ching

An epiphyte with fertile frond. It is so far recorded from China only by Ching. Kothong, June 1961, *Deb* 26036.

L. sordidus (C. Chr.) Ching

An epiphyte; frond fertile. Kothong, June 1961, *Deb* 26035.

Microsorium cuspidatum (D. Don) Tagawa

An epiphyte with creeping rhizome; frond fertile; not rare. Lailongsong, June 1961, *Deb* 25843; Soha village, Oct. 1959, *Rao* 20269.

M. punctatum (Linn.) Copel.

An epiphyte in humid forest; not scarce. Lailongsong, June 1961, *Deb* 25845.

M. zippelii (Bl.) Ching

An epiphyte; frond fertile; common. Kothong, June 1961, *Deb* 26111.

Pleopeltis caudato-attenuata (Takeda) Patnaik

An epiphyte on trees; frond fertile; not rare. Chenglang, Oct. 1959, *Rao* 20249.

P. thunburgiana Kaulf.

An epiphyte; frond fertile; common. Kothong, June 1961, *Deb* 26108.

Polyopodium amoenum Wall. ex Mett.

An epiphyte on mossy bark; frond fertile; common. Kothong, June 1961, *Deb* 26108.

Pyrrosia adnascens (Sw.) Ching

An epiphytic herb; frond fertile. Jangkeng village, June 1961, *Deb* 25875.

P. beddomcana (Gies.) Ching

An epiphyte; caudex tufted, frond fertile; not rare. Lailongsong, June 1961, *Deb* 25844.

P. flocculosa (D. Don) Ching

An epiphyte on mossy bark of trees; frond fertile, not rare. Kothong, June 1961, *Deb* 26106.

P. heteracta (Mett.) Ching

An epiphyte with fertile frond; rhizomatous; common. Nampong-Soha, Oct. 1959, *Rao* 20351(1); Langsang forest, June 1961, *Deb* 26168; Kothong, June 1961, *Deb* 26112.

P. lanceolata (Linn.) Farwell

An epiphyte, frond fertile; not rare. Chenglang, Oct. 1959, *Rao* 20252.

P. mollis (Kze.) Ching

An epiphyte with fertile fronds; common. A Chinese plant. Noglo, June 1961, *Deb* 26360.

P. mannii (Gies.) Ching

An epiphyte with fertile fronds; not rare. Kothong, June 1961, *Deb* 26034; Longseck hillock, June 1961, *Deb* 25771.

P. nummularifolia (Sw.) Ching

An epiphyte, leaves dimorphic; frond fertile; common. Khonsa, June 1961, *Deb* 25927; Raho-Wakka, July 1961, *Deb* 26454; Longseck hillock, June 1961, *Deb* 25770; Namchick, Oct. 1959, *Rao* 20192.

P. stenophylla (Bedd.) Ching

An epiphyte with rhizomes; frond fertile; not rare. Kothong, June 1961, *Deb* 26110.

DICOTYLEDONS

MAGNOLIACEAE

Manglietia insignis Bl.

A lofty tree in fruit; common in the evergreen forest. Deomali, June 1961, *Deb* 25899.

Talauma hodgsoni Hook. f. & Thoms.

A lofty tree; common in the evergreen forest. Chenglang, Oct. 1959, *Rao* 20277; Deomali, Oct. 1959, *Rao* 20325; Lailongsong, 510 m., June 1961, *Deb* 25774.

ANNONACEAE

Goniothalamus sesquipedalis Hook. f. & Thoms.

A shrub, scattered all over the evergreen forest as an undergrowth. Banfera, July 1961, *Deb* 26728; Aug. 1958, *Panigrahi*, *S.N.*

Fissistigma bicolor (Roxb.) Merr.

A large woody climber, rare. Lailongsong, 510 m., June 1961, *Deb* 25808.

F. manubriatum (Hook. f. & Thoms.) Merr.

A shrub. Noglo (Burma border), June 1961, *Deb* 26321. It has been recorded for India by the authors in *Bull. Bot. Soc. Beng.* 19 (1): 37, 1965.

LAURACEAE

Actinodaphne obovata Bl.

A medium-sized tree; scarce. Banfera, July, 1961, *Deb* 26693.

Cinnamomum pauciflorum Nees

A tree in flower. Longseck hillock, June 1961, *Deb* 25724.

C. tamala F. Nees & Eberm.

A large tree. Deomali, Oct. 1959, *Rao* 20312; Khonsa, June 1961, *Deb* 25952.

Lindera neesiana Benth.

A small tree in flower; common. Kothong, June 1961, *Deb* 26042; Khonsa, June 1961, *Deb* 25956.

Litsea citrata Bl.

A small tree with long spreading branches; fairly common. Chenglang to Khela, Oct. 1959, *Rao* 20300; Longseck hillock, June 1961, *Deb* 25726.

L. kingii Hook. f.

A medium-sized tree, common along the Burma border. Chegum, July 1961, *Deb* 26468.

L. laeta Wall. ex Nees

A small tree in fruit; scarce. Pungchow, July 1961, *Deb* 26606; Langsang, June 1961, *Deb* 26146.

L. lancifolia Roxb. ex Wall.

A large tree dominant in the locality. Chegum, July 1961, *Deb* 26463.

L. monopetala (Roxb.) Pers.

A large tree in flower and fruit; common. Khela, March 1958, *Murthy* 12975; Longseck hillock, 1500 m., June 1961, *Deb* 25730 & 25744; Kothong, June 1961, *Deb* 26030; Khela, June 1961, *Deb* 25928.

L. oblonga (Wall.) Hook. f.

A small tree. Banfera, July 1961, *Deb* 26705.

L. salicifolia (Roxb. ex Wall.) Hook. f. var. **attenuata** Meissn.

A shrub. Wakka, July 1961, *Deb* 26541.

L. semecarpifolia (Wall.) Hook. f.

A large tree. One of the dominant trees of Burma border forests. Noglo, June 1961, *Deb* 26306.

L. thomsoi Mnieissn.

A tree in flower; rare. Wakka, July 1961, *Deb* 26455.

Persea minutiflora Kosterm.

A tree in flower. Khonsa, June 1961, *Deb* 25961.

Phoebe lanceolata Nees

A medium-sized tree. Longseck hillock, June 1961, *Deb* 25725.

HERNANDIACEAE

Illigera villosa C. B. Clarke

A large climber with purple flowers; widely scattered. Chennhang, June 1961, *Deb* 26223; Chegum-Wakka, July 1961, *Deb* 26495; Kothong, June 1961, *Deb* 26053.

MYRISTICACEAE

Knema globularia (Lamk.) Warb.

A medium-sized tree; fairly common in the evergreen forest. Longseck hillock, June 1961, *Deb* 25723.

K. angustifolia (Roxb.) Warb.

A medium-sized tree with blood red sap; fairly common in the evergreen forest. Fruits 2.5-3.8 cm., glaucous, pericarp yellowish, aril purple. Longseck hillock, June 1961, *Deb* 25722.

K. linifolia (Roxb.) Warb.

A medium-sized tree; fairly common in the evergreen forest. Longseck hillock, 1500 m., June 1961, *Deb* 25723 A.

DILLENIACEAE

Dillenia indica Linn.

A large tree up to 35 m. in height in flower and fruit; scattered. Namchik, 152 m., Oct. 1959, *Rao* 20195.

CONNARACEAE

Connarus paniculatus Roxb.

A climber in fruit; scattered near the valleys. Kanubari, July 1961, *Deb* 26758.

Rourea caudata Planch.

A small tree fairly common in subtropical forests. Noglo (Burma border), June 1961, *Deb* 26349.

ROSACEAE

Duchesnea indica (Andr.) Focke

(Syn. *Fragaria indica* Andrews)

A small herb; rare. Nampong, Oct. 1959, *Rao* 20031.

Neillia thyrsoiflora D. Don

A shrub in flower and fruit. Tinchha, Aug. 1958, *Panigrahi* 14648; Kothong, June 1961, *Deb* 26063.

Potentilla kleiniana Wight & Arn.

A diffused herb in flower and fruit; scattered. Laju, June 1961, *Deb* 25972.

Prunus acuminata Hook. f.

A small tree in flower; rare. Pungchow, July 1961, *Deb* 26627.

P. persica (L.) Batsch

Cultivated. Soha village, Oct. 1959, *Rao* 20387.

Rubus burkilli Rolfe

A scandent shrub with yellow flowers; scarce. Raho, Aug. 1958, *Panigrahi* 16849; Chegum, July 1961, *Deb* 26476.

R. ferox Wall. ex Kurz

A prickly scandent shrub in flower; rare. Langsang forest (Kothong), June 1961, *Deb* 26155.

R. insignis Hook. f.

A scandent shrub with rose red flowers; scarce. Chenglang, March 1958, *Murthy* 12911.

R. lasiocarpus Smith

A straggling shrub with white flowers and orange red drupelets; scarce. Kothong, June 1961, *Deb* 26094; Khonsa, June 1961, *Deb* 25988.

R. lineatus Reinw.

A shrub with light green flowers; fairly common. Raho, July 1961, *Deb* 26420; Nampong, Oct. 1959, *Rao* 20012; Noglo, June 1961, *Deb* 26332.

R. lucens Focke

A straggling shrub with rose red flowers; common. Jairampur, Oct. 1959, *Rao* 19924; Nampong, Oct. 1959, *Rao* 20060.

R. moluccanus Linn. var. **macrocarpa** Gard.

A straggling shrub with hooked thorns all over. Flowers white; scarce. Lailongsong, 510 m., June 1961, *Deb* 25780; Khonsa, June 1961, *Deb* 25973; Kothong, June 1961, *Deb* 26084.

CAESALPINIACEAE

Bauhinia khasiana Baker

A small climber with golden yellow flowers; scarce. Longseck hillock, June 1961, *Deb* 25721.

B. purpurea L.

A tall tree with large white flowers having odd petal pinkish violet; scarce. Deomali, Oct. 1959, *Rao* 20306; Chenglang, March 1968, *Murthy* 12930.

B. tenuiflora Watt ex. C. B. Clarke

A climber with white flowers. Flowers yellowish on drying; scarce. Noglo, June 1961, *Deb* 26322; Chennhang, June 1961, *Deb* 26274.

MIMOSACEAE

Acacia intsia (L.) Willd.

A tall climber with white flowers; rare. Jairampur, Oct. 1959, *Rao* 19941.

Albizzia gamblei Prain

A shrub in flower; scarce. Chennhang, June 1961, *Deb* 26205.

A. lucida (Roxb.) Benth.

A medium sized tree in white flowers; common. Grows in association with *Macaranga* on slopes.

A. mollis Boiv.

A large tree; scattered. Khonsa, June 1961, *Deb* 25942. Noglo, June 1961, *Deb* 26309.

A. chinensis (Osbeck) Merr.

A tree with brown legumes; scattered. Nagnu, Aug. 1968, *Panigrahi* 14871; Kothong, June 1961, *Deb* 26082; Khela, June 1961, *Deb* 25930. Khonsa, June 1961, *Deb* 25985.

Entada pursaetha DC.

A gigantic climber in fruit on the outskirts of the forest; scarce. Banfera, July 1961, *Deb* 26729.

Mimosa pudica L.

Common. Pangsupass, Oct. 1959, *Rao* 20152.

Pithecellobium angulatum Benth.

A small tree in flower; scarce. Lailongsong, 510 m., June 1961, *Deb* 25789; Banfera, July 1961, *Deb* 26744.

PAPILIONACEAE

Cicer arietinum L.

Cultivated herb. Khela, March 1958, *Murthy* 12981.

Crotalaria ferruginea Grah. ex Benth.

An undershrub with yellow flowers; scarce. Pangsupass, 290-1130 m., Oct. 1959, *Rao* 20091; Pungchow, July 1961, *Deb* 26567.

C. tetragona Andrews

A shrub with yellow flowers. Namsang, Oct. 1959, *Rao* 20340.

Desmodium laburnifolium DC.

A herb in flower and fruit; scattered. Jairampur, Oct. 1959, *Rao* 19920.

D. laxiflorum DC.

A small shrubby plant with bluish flowers; fairly common. Pangsupass, 290-1130 m., Oct. 1959, *Rao* 20011; Jairampur, 199.3 m., Oct. 1959, *Rao* 11984.

D. heterocarpum (L.) DC.

A small spreading shrub with small pinkish, brownish or bluish violet flowers; common. Jairampur, Oct. 1959, *Rao* 19918 & 19970.

D. sequax Wall.

A shrub with pinkish blue flowers; fairly abundant at places. Khela, Oct. 1959, *Rao* 20285; Noglo, June 1961, *Deb* 26376.

Indigofera cylindrica Grah.

A shrub up to 3 m. in height, in flower and fruit; scarce. Chennhang, June 1961, *Deb* 26213.

I. dosua Buch.-Ham. var. **tomentosa** Baker

A shrub in flower; fairly abundant at places. Wakka, July 1961, *Deb* 26497.

Millettia caudata Baker

A small tree with white flowers; scarce. Lailongsong, 510 m., June 1961, *Deb* 25790.

M. cinerea Benth.

A climber with pink flowers; rare. Pungchow, July 1961, *Deb* 26599.

M. pulchra Benth. ex Baker

A shrub with pink flowers; scarce. Pungchow, July 1961, *Deb* 26646.

M. monosperma DC.

A large climber in flower; scarce. Jairampur, Oct. 1959, *Rao* 19966.

Phaseolus calcaratus Roxb.

A herb with yellow flowers; cultivated. Namsang-Soha, Oct. 1959, *Rao* 20346.

P. mungo L.

A climber about 3 m. in height, flowers yellow; scarce. Bimalpur, Sept. 1958, *Panigrahi* 17033.

Pueraria bella Prain

A climber, flowers pinkish white, calyx yellowish green; Khonsa, Aug. 1958, *Panigrahi* 14490.

P. peduncularis Grah.

A climber up to 10 m. in height; flowers yellowish or bluish white; rare. Tinchha, Aug. 1958, *Panigrahi* 14647.

P. phaseoloides Benth.

A climber with orange yellow or bluish flowers; fairly common in places. Tinchha, Aug. 1958, *Panigrahi* 14633; Pangsupass, Oct. 1959, *Rao* 20009; Namsang, Oct. 1959, *Rao* 20339.

Shuteria vestita Wt. & Arn.

A twiner with small brownish flower; scarce. Khela, March 1958, *Murthy* 12977; Noglo, June 1961, *Deb* 26303.

Smithia ciliata Royle

A herb with sensitive leaves and yellow flowers; scarce. Pangsupass, Oct. 1959, *Rao* 20048 & 20049.

Butea parviflora Roxb.

An extensive climber with purple flowers. Khonsa, June 1961, *Deb* 25965.

Tephrosia candida DC.

A shrub with white flowers and fruits; abundant in places. Namsang, Oct. 1959, *Rao* 20334.

PHILADELPHACEAE

Dichroa febrifuga Lour.

A shrub, flowers blue, fruits pale green to chocolate grey; common. Kothong, June 1961, *Deb* 26060; Khonsa, June 1961, *Deb* 25964; Chennhang, June 1961, *Deb* 26261, 26267 & 26268.

HYDRANGEACEAE

Hydrangea robusta Hook. f. & Thoms.

A shrub with blue violet flowers; abundant in places. Kothong, June 1961, *Deb* 26047; Noglo, June 1961, *Deb* 26320.

H. robusta Hook. f. & Thoms. var. **griffithii** C. B. Clarke

A shrub with blue violet flowers; scarce. Khonsa, June 1961, *Deb* 25982.

ESCALLONIACEAE

Itea chinensis Hook. & Arn.

A small tree in flower and fruit; scarce. Wakka, July 1961, *Deb* 26521.

I. macrophylla Wall.

A shrub of about 8 m., in flower and fruit; common. Kothong, June 1961, *Deb* 26029 & 26083; Longseck hillock, 510 m., June 1961, *Deb* 25733.

CRYPTERONIACEAE

Crypteronia glabra Bl.

A tree with spreading branches; scarce. Namsang, Oct. 1959, *Rao* 20350.

(to be continued)